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Abstract

Distinguishing trajectories of criminal offending over the life course, especially the prediction of high-rate offenders, has received considerable attention over the past two decades. Motivated by a recent study by Sampson and Laub (2003), this study uses longitudinal data on conviction histories from the Dutch Criminal Career and Life-Course Study (CCLS) to examine whether adolescent risk factors predict offending trajectories across the life span. The CCLS is particularly well suited to study developmental offending trajectories as it contains detailed information on individual criminal offending careers for a representative sample of all individuals convicted in the Netherlands in 1977 ($n = 4,615$) beginning at 12 years of age and continuing into late adulthood. To assess predictive

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ability, the authors employ two different analytical approaches. First, the authors examine whether offending trajectories can be prospectively differentiated by risk factors identified in adolescence. Second, the authors use group-based trajectory analysis to retrospectively identify distinct developmental offending trajectories and employ a cross-validation technique to examine the ability to predict the probability of an individual's membership in a particular trajectory group. Overall, the results support the notion that it is difficult to predict long-term patterns of criminal offending using risk factors identified early in the life course.

Keywords

age and crime, trajectories, prediction, desistance

Over the past two decades, the developmental course of criminal offending has received considerable theoretical and research attention. On one hand, Gottfredson and Hirschi (1990) argued that the age-crime relationship is invariant and that all offenders commit fewer offenses as they age. In contrast, Blumstein and colleagues (Blumstein, Cohen, and Farrington 1988; Blumstein et al. 1986) maintained that the age-crime relationship varies and that a relatively small group of chronic offenders do not desist from crime with age (see also Piquero, Farrington, and Blumstein 2007). Along similar lines, Moffitt (1993, 1994) contended that there is a dual taxonomy of offenders: a life course-persistent group wherein offending does not decline with age and an adolescence-limited group wherein offending is concentrated during the teenage years (for similar typological approaches, see Loeber and LeBlanc 1990; Patterson and Yoerger 1993).

To date, research using a variety of data collected from different sociohistorical times and geographic locales has found evidence of considerable heterogeneity in offending patterns over the life course (Ezell and Cohen 2005; Laub and Sampson 2003; Piquero et al. 2007). One question that has emerged from these studies is whether it is possible to distinguish or predict these varying criminal offending trajectories, especially the chronic high-rate offender group, using risk factors identified early in the life course. Using a particularly rich data set, Sampson and Laub (2003) tackled this question of prediction by examining long-term criminal trajectories for a sample of high-risk boys using a variety of factors occurring in childhood and early adolescence. Contrary to the work of Moffitt, among others, Sampson and Laub found that prediction was at best problematic as there was no evidence that individual, childhood, and/or family risk factors could predict long-term trajectories of

criminal offending (see also Laub and Sampson 2003; Sampson and Laub 2005).

Although Sampson and Laub's (2003) findings are compelling, the generalizability of their results is questionable. Specifically, we do not know the extent to which their findings are specific to the sociohistorical context of their study or the individuals in their analysis. Moreover, the fact that these findings have significant implications for extant criminological theory as well as policies that seek early intervention in childhood to ward off serious adolescent and adult offending, a replication of their analysis is essential. The aim of the current research is to assess the robustness of these important findings utilizing data gathered in a more contemporary, cross-national context with a sample containing nearly 5,000 convicted individuals.

We wish to note the growing recognition of two salient factors within criminology that are of particular relevance to the current study. First, there is an increasing appreciation that research should not be restricted to data from the United States. Although recognition of the need for more cross-national comparative studies¹ is not new (see Glueck 1964), this concern has grown in recent years (see Adler 1996; Farrington and Wikström 1994; LaFree 2007). For instance, in his presidential address to the American Society of Criminology, Gary LaFree (2007:14) noted: "Stating that you are in favor of more comparative cross-national research in criminology is a bit like saying that you are opposed to premeditated murder—hardly anyone will disagree with you." Our study adds to the small but growing collection of comparative cross-national criminological research. To the extent that our findings are similar or different to those of Sampson and Laub (2003), we garner an increased understanding of the generalizability of the findings regarding the ability to predict long-term trajectories of criminal offending.

Second, whether it is through the replication of key findings or the systematic statistical summary of information via meta-analysis, there is a growing recognition of the importance of doing a better job of cumulating knowledge (Gendreau 2001; Lowenkamp, Cullen, and Pratt 2003). Our article contributes to the need of replication studies in criminology and expands upon previous studies of prediction of high-rate offenders. The research presented here is especially important given that we are just beginning to understand the development of offending over the life course and because the implications of predicting distinct offending trajectories hold promise for public policy initiatives. We begin with a brief review of the relevant literature before moving on to a detailed discussion of the research presented here.

Prediction of Offending Trajectories

Although the prediction of future offending behavior has a long history in criminology and criminal justice (see Gottfredson 1987; Harcourt 2006), it received increased popularity with the finding by Wolfgang, Figlio, and Sellin (1972) that a small portion of the population was responsible for a large portion of crime. With this finding came the belief that if this small group of chronic offenders could be identified in advance, then presumably a large amount of crime could be prevented (Cohen 1983). However, identifying this small group of chronic offenders in advance has been problematic due to a number of legal, ethical, and methodological concerns (see Auerhahn 1999, 2006; Bernard and Ritti 1991; Gottfredson and Moriarty 2006; Tonry 1987). Nonetheless, the prediction of those most at risk for high-rate offending remains a highly sought after goal.

The growth of developmental criminology and the accompanying characterization of offender types add another dimension to the prediction literature (e.g., Loeber and LeBlanc 1990; Moffitt 1993; Patterson and Yoerger 1993). These researchers posit that there are distinct groups of offenders whose developmental etiology can be linked to early risk factors. Today, one of the most prominent theories in developmental criminology is Moffitt's (1993) dual taxonomy theory. Moffitt proposed that there are two typologies of offenders: adolescence limited and life course-persistent. The adolescence-limited offender follows a typical path, initiating delinquent involvement in early adolescence with the peak of involvement occurring in mid-adolescence followed by desistance in young adulthood. Moffitt suggested that adolescence-limited delinquent behavior represents a standard developmental sequence where adolescents are caught in a "maturity gap" between childhood and adulthood. Their behavior is thus a temporary declaration of autonomy and boundary testing. In fact, their involvement in delinquent acts is deemed normative.

Conversely, life course-persistent offenders comprise a small percentage of individuals who initiate problematic behavior early in life and remain highly delinquent/criminal throughout their lifetime. Moffitt (1993) contended that neurological deficiencies, in tandem with deficient environments in childhood, lead to the development of the life course-persistent offender. She suggested that the prospective prediction of the life course-persistent offender should be most effective when employing measures of individual and family characteristics such as

gender, temperament, cognitive abilities, and family bonds. The prediction of these individuals is of particular concern due to the likely long-term detrimental consequences to both self and society.

In a recent article, Sampson and Laub (2003) examined whether they could predict criminal trajectory patterns using data spanning virtually the entire life course (ages 7–70) for a sample of nearly 500 high-risk boys from the Gluecks' classic study of juvenile delinquency and young adult crime (Glueck and Glueck 1950; see also Laub and Sampson 2003; Sampson and Laub 2005). The authors addressed two key questions: whether there was a distinct offender group whose rates of crime remained stable with increasing age and whether individual differences, childhood characteristics, and family background could foretell long-term trajectories of offending.

Three important findings were revealed in Sampson and Laub's (2003) analysis. First, when examined in the aggregate the pattern of offending that emerged was one of a unimodal peak in crime in adolescence followed by a decline through middle adulthood. Specifically, desistance from crime was the norm even among a sample of high-risk boys (see also Blokland, Nagin, and Nieuwbeerta 2005; Ezell and Cohen 2005; Piquero et al. 2007). Second, they found evidence of considerable heterogeneity in individual age-crime curves across the life span (see also Blokland et al. 2005; Ezell and Cohen 2005; Piquero et al. 2007). Finally, Sampson and Laub investigated whether long-term patterns of offending could be predicted from a number of child and adolescent risk factors, including cognitive ability, temperament, personality traits, childhood behaviors, early onset, and frequency of involvement in crime and delinquency. Across an array of varying risk factors, the predictive power of individual differences, childhood factors, and family background in identifying a distinct group of life course–persistent offenders (Moffitt 1993) was not substantiated. Specifically, there was no evidence that individual, child, and family risk factors could predict long-term trajectories of criminal offending once conditioned on delinquency.

Current Study

The conclusions proffered by Sampson and Laub (2003) appear rather dismal for criminological theory and public policy interventions rooted in an early risk factor approach, but it would be imprudent to make recommendations based on these findings alone. Nevertheless, the availability of data for conducting an investigation similar to the one undertaken by Sampson and Laub are rare, as such an analysis requires

data covering the vast majority of an individual's life course in addition to the accessibility of information on important risk factors traced to persistent offending in later life. Moreover, it is advantageous to have a large sample size with a sufficient number of serious offenders. This feature is particularly important in light of base rate problems that characterize much prediction-based research (Gottfredson and Moriarty 2006). Data collected by the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR) offer a unique opportunity to conduct a partial replication of the Sampson and Laub study as the data meet these essential requirements. That is, the sample consists of more than 5,000 offenders who were convicted in 1977 with data spanning a large portion of the life course (i.e., adolescence, young adulthood, and later adulthood; for details, see Nieuwbeerta and Blokland 2003).

With this article, we aim to increase criminological knowledge by adding to the discussion concerning the prediction of criminal careers. Specifically, we test the robustness of Sampson and Laub's (2003) findings by replicating and extending their study regarding the prediction of offending trajectories. First, we examine long-term patterns of offending (ages 18 to 55) in a cross-national context utilizing data gathered on a large sample of convicted men and women in the Netherlands born between 1907 and 1965. Due to the cross-national context and varying sociohistorical periods, these data provide us with the unique opportunity to assess the generalizability of Sampson and Laub's findings. Second, following the Sampson and Laub analysis, we examine whether trajectories of criminal offending can be prospectively differentiated by key risk factors identified in adolescence. Finally, we propose an alternative test of the prediction of offending trajectories. Specifically, we use group-based trajectory analysis to identify retrospectively distinct developmental offending trajectories and employ a cross-validation technique to test our ability to predict the probability of an individual's membership in a particular group.

Data and Measures

In this study, we use data from the Criminal Career and Life-Course Study (CCLS), a large-scale longitudinal study carried out at the NSCR (Nieuwbeerta and Blokland 2003). The CCLS is based on a representative sample of 4 percent of all cases of criminal offenses that were tried in the Netherlands in 1977. The total sample consists of 5,164 convicted individuals. The principal investigators for the CCLS were able to trace

89.4 percent of the original sample, resulting in a final sample size of 4,615 (4,187 men and 428 women). The characteristics of these 4,615 individuals are similar to the total sample consisting of 5,164 persons and therefore can be regarded as representative of all offenders in 1977.²

Subsample

In addition to analyzing the full CCLS sample, we also carry out separate analyses on a random subset of male offenders ($n = 689$) from the original CCLS data. Research supports that factors such as low intelligence and psychological instability are important predictors of chronic offending trajectories (DeLisi 2005; Fergusson and Horwood 2002; Moffitt, Lynam, and Silva 1994). To measure the predictive utility of these factors, we utilize data collected from the Ministry of Defense, which contain information on individual traits compiled from psychological and physical assessments conducted when the men were 18 years of age and drafted for military service.³

Criminal Career Data

The criminal careers of the offenders in the CCLS sample were reconstructed using abstracts from the General Documentation Files (GDF) of the Criminal Record Office ("rap sheets"). The GDF contain information on every criminal case registered by the police at the Public Prosecutor's Office.⁴ These abstracts were supplemented with information that normally would not be included due to statutory limitations. That is, in the Netherlands a person is not given a "blank sheet" upon becoming an adult. Therefore, the data used here contain information on both juvenile and adult official offenses. The standard classification system used in the Netherlands groups offenses into the following categories: violent offenses (i.e., sexual offenses, robbery), property offenses, vandalism and offenses against the public order, drug offenses, offenses of the Firearms Act, and other criminal law offenses (e.g., drunk driving, hit and run).⁵

This data set is not only sizable but also covers a large portion of the adult life course. Individual offending rates are measured annually beginning when the offenders were aged 12 up to the year 2002. Because the data pertain to a sample of all convicted persons in 1977, the participants range in age from 12 to 79 years old. Thus, although data for everyone in the sample are available beginning at age 12, depending on

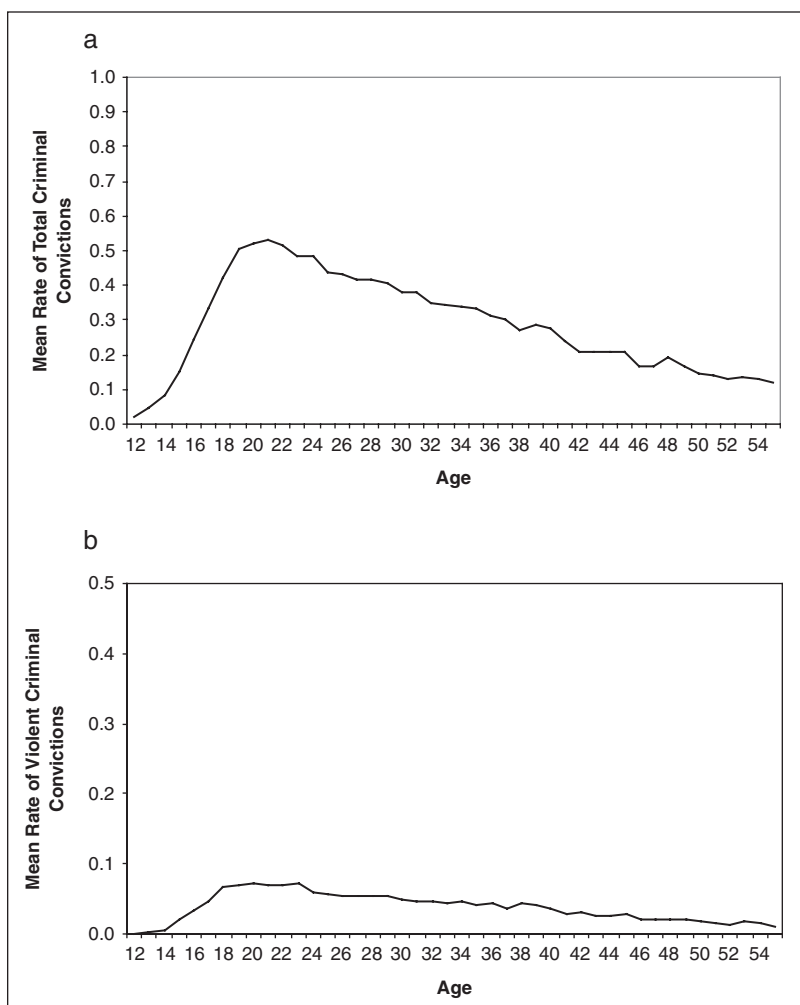


Figure 1. Mean rate of offenses by criminal conviction type ($n = 4,615$)

1a. Mean rate of total criminal convictions (ages 12–55)

1b. Mean rate of violent criminal convictions (ages 12–55)

one's age at conviction in 1977, the amount of follow-up data available for any one individual varies.⁶ To avoid problems associated with having only a small number of individuals defining offending trajectories at the oldest ages, we limit the analysis to ages for which data are available on

a substantial number of individuals. This restriction censors our offending trajectories at 55 years of age. In addition, taking into account mortality, each observation is censored after the time of death.

The data contain 177,137 person-by-age crime counts from ages 12 to 55. We present the actual mean conviction rate for all crimes and for violent crimes in Figures 1a and 1b, respectively. Clearly, for both the total crime and violent crime measures, the age-crime pattern is asymmetric, representing 21,024 person-years in which one or more crime convictions were recorded. These figures illustrate that the crime trends peak in adolescence and decline through middle adulthood.

Risk Factors

To examine whether trajectories of offending can be differentiated by risk factors identified in adolescence, we employ four risk factors: two measures of criminal history (i.e., early onset, chronic offending) and two measures of individual traits believed to be related to crime (i.e., low intelligence, psychological instability).

Early onset of criminal offending has been identified as one of the strongest predictors of long-term offending (Blumstein et al., 1986; DeLisi 2005; Farrington et al. 1990; Loeber and LeBlanc 1990; Piquero et al. 2007). Research suggests that individuals who begin offending at early ages are likely to have longer, more varied, and more serious criminal careers than those who initiate their criminal behavior at a later age (for thorough reviews, see LeBlanc and Loeber 1998; Thornberry and Krohn 2003). In the present study, we capture early onset with a measure of age at first conviction obtained from official reports. Those respondents who had a criminal conviction history at 15 years of age or younger are categorized as having an early onset of offending (*early onset* = 1, comprising 17 percent of the sample).

Our second risk factor captures the frequency of official convictions during adolescence (i.e., prior to age 18). Beginning in the early 1970s, criminal career researchers identified a small subgroup of individuals, "chronic offenders," who account for a disproportionately large number of crimes (Wolfgang et al. 1972). This research suggests that individuals identified as chronic offenders have an increased likelihood of maintaining their criminal behavior into adulthood (Farrington 2003; Piquero et al. 2007). Therefore, by placing an additional restriction on our designation of at risk, including only those individuals with a history of five

or more criminal convictions prior to 18 years of age, we garner increased assurance that our risk factor captures those individuals who fit the criminal career persister and life course–persistent profiles (Blumstein, Farrington, and Moitra 1985; Moffitt 1993). Individuals with the chronic offender classification comprise nearly 5 percent of our sample (*chronic offending* = 1), which is consistent with the criminal career literature.

Information pertaining to intelligence and psychological instability is only available for the subsample ($n = 689$). In the Netherlands, men aged 18 were physically and psychologically tested for military service. This information is archived with the Dutch Ministry of Defense and is available for all men born after 1940. The examination consisted of three parts and evaluated an array of factors, including general physical condition, practical insight, intelligence, psychological stability, and mathematical and language skills. Based on these assessments, the military examination committee classified the man as fit for military service, not fit due to physical limitations, not fit due to low intelligence, and not fit due to psychological instability. We use the last two outcomes as indicators of two additional risk factors: low intelligence and psychological instability. Both factors are believed to differentiate lifelong trajectories of criminal offending (DeLisi 2005; Fergusson and Horwood 2002; Ge, Donnellan, and Wenk 2001; Moffitt 1993; Moffitt et al. 1994; Piquero, Brame, and Lynam 2004; Piquero et al. 2007; Stattin and Klackenber-Larsson 1993). Specifically, individuals with low intelligence and/or psychological instability have a greater likelihood of becoming involved in criminal behavior and are more likely to have a high rate of criminal involvement over the life course. In our sample, 102 of the 689 men (15 percent) were deemed not fit for military service due to low intelligence (coded 1) and 97 of the 689 men (14 percent) were declared not fit due to psychological instability (coded 1).

Prospectively Defined Groups

Our study starts by using a similar strategy as Sampson and Laub (2003) to analyze the predictability of long-term patterns of offending. Specifically, we examine whether trajectories of offending can be prospectively differentiated by risk factors identified in adolescence. The basic question posed by Sampson and Laub and examined here asks whether the age-crime trajectory follows a different pattern across the life course of offenders distinguished by adolescent risk factors.

To address this question, we analyze a series of predicted probability models. These models estimate the probability of a criminal conviction at each age from which a mean probability is calculated. Because of the relative rarity of criminal convictions in each age period, we estimate logistic regression models with three age terms (age, age², age³) and present the findings for any criminal conviction and violent criminal conviction at each age from 18 to 55.⁷ Although we are limited in capturing the wide range of predictors assessed by Sampson and Laub, we employ four key risk factors here: early onset, chronic offending in adolescence, low intelligence, and psychological instability.

Full Sample Analysis

We begin by estimating the predicted probabilities for any criminal conviction by early onset of offending (Figure 2a). Throughout young adulthood, those in the early onset group have a higher mean level of offending than those who do not have an early onset. It is evident, however, that although the two groups have different levels of offending, the shape of the offending trajectories across the life course is very similar. That is, offending in both groups peaks in early adulthood followed by a gradual decline with age.

Because our any criminal conviction measure includes a diverse array of crimes, it may be possible that this measure obscures important patterns in the data. Specifically, Moffitt (2006) contended that individuals displaying life course–persistent patterns of offending show the greatest divergence from adolescent-limited offenders within the realm of violence. Therefore, we restrict our analysis to focus on violent criminal convictions (see Figure 2b). The findings for violent criminal conviction by early onset reveal a remarkably similar pattern to those using any criminal conviction. The early onset risk group has a higher mean probability of a violent conviction in early adulthood, but by mid-adulthood their probability of offending is indistinguishable from that of the low risk group. Moreover, by age 40 the two groups are nearly identical.

To capture the small subset of chronic offenders who may be more likely to display stable patterns of offending throughout the life course, we repeat the analysis using our second measure of risk: chronic offending in adolescence. This measure captures the small portion of our sample that has a history of five or more criminal convictions prior to age 18. We present the findings for any and violent criminal convictions in Figures 2c and 2d, respectively. Again, we find that although the groups differ in their

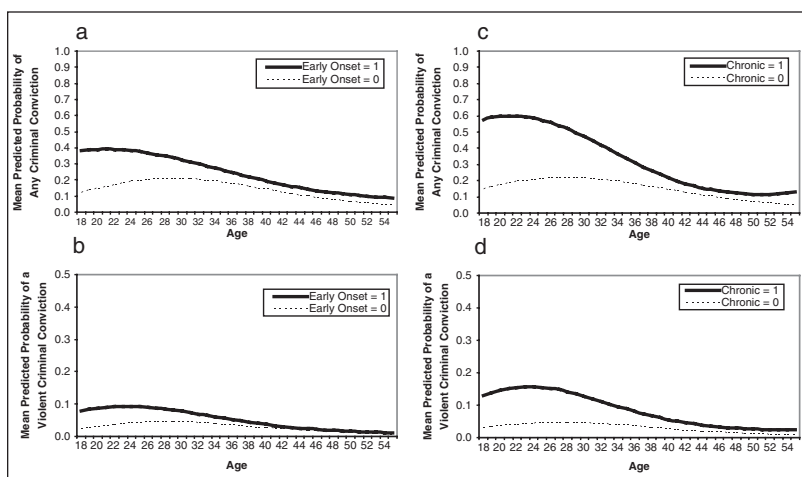


Figure 2. Mean predicted probability of conviction for risk factors: early onset, chronic offending (ages 18–55; $n = 4,615$)

2a. Any criminal conviction by early onset

2b. Violent criminal conviction by early onset

2c. Any criminal conviction by chronic offending

2d. Violent criminal conviction by chronic offending

rates of offending, the overall long-term pattern remains unchanged. Regardless of whether individuals are designated as a chronic offender or not, a declining pattern of criminal offending across adulthood is evidenced.⁸

Because there is no agreed upon marker identifying an “early onset offender” or a “chronic adolescent offender” in the extant literature, we repeat the analysis four additional times imposing different restrictions on the composition of the at-risk group. First, we restrict the early onset risk indicator to capture only those with a criminal conviction at 13 years of age or younger (4 percent of the sample). Second, we restrict the early onset indicator to represent those with a violent criminal conviction at 15 years of age or younger (3 percent of the sample). Third, we restrict the chronic offender indicator to represent those with two or more violent criminal convictions up to 17 years of age or younger (2 percent of the sample). Even with these additional restrictions, we find a general pattern of desistance among those at greatest risk for continued offending (results not shown).

Fourth and finally, to isolate the most at-risk individuals in our sample, we create a risk factor that captures those youth who have both an early

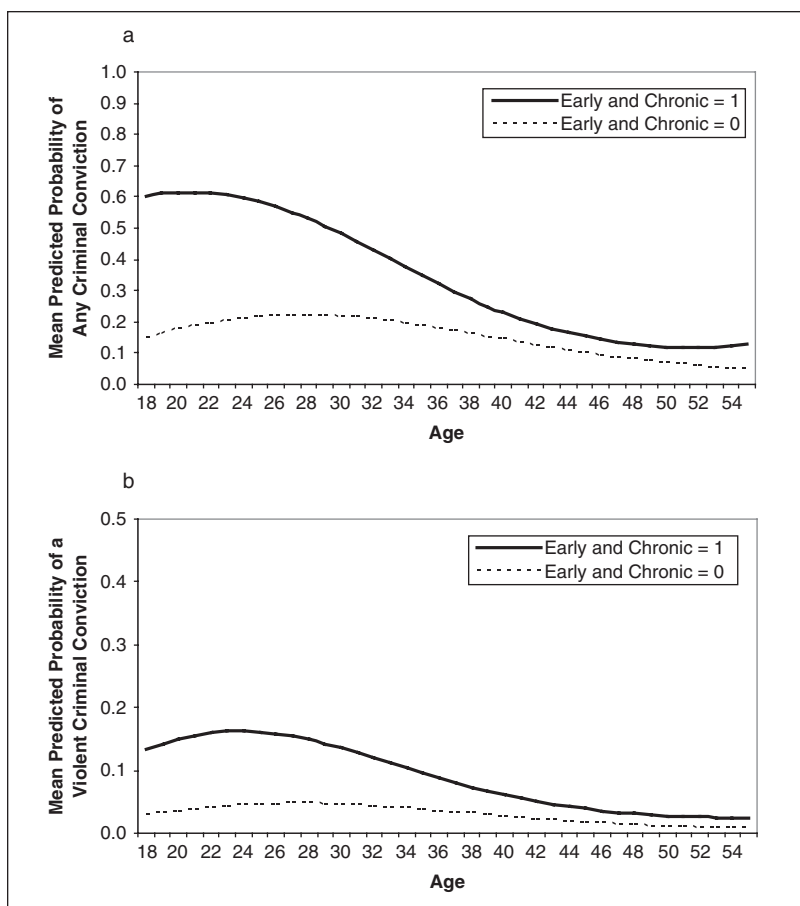


Figure 3. Mean predicted probability of conviction for risk factor: early onset and chronic offending (ages 18–55; $n = 4,615$)

3a. Any criminal conviction by early onset and chronic offending

3b. Violent criminal conviction by early onset and chronic offending

onset of offending (prior to 15 years of age) and a history of chronic offending in adolescence (five or more criminal convictions prior to 18 years of age). This group represents arguably the most at-risk youth in the sample (4 percent). We present the findings for this group looking at both any and violent criminal convictions in Figures 3a and 3b. In general, although

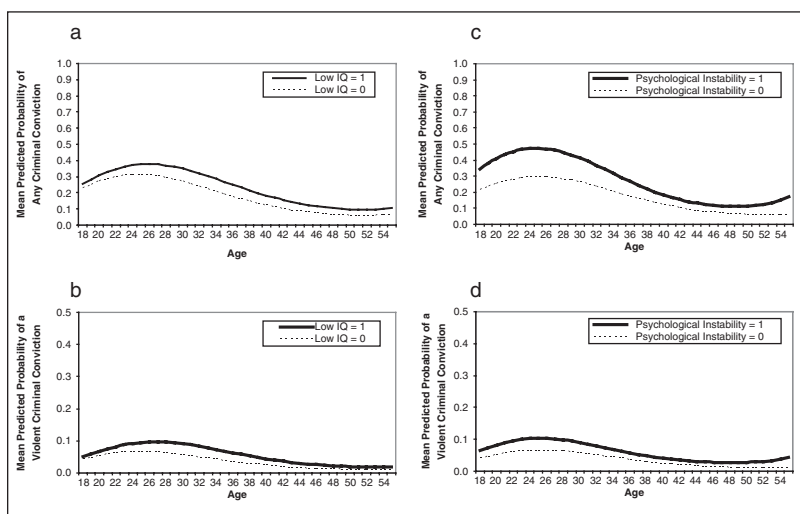


Figure 4. Mean predicted probability of conviction for risk factors: low IQ and psychological instability (ages 18–55; $n = 689$)

4a. Any criminal conviction by low IQ

4b. Violent criminal conviction by low IQ

4c. Any criminal conviction by psychological instability

4d. Violent criminal conviction by psychological instability

there are magnitude differences during early adulthood, we find yet again that all groups evidence a sharp declining pattern with age.

Subsample Analysis

Using a random subsample of cases, we investigate the predictive ability of two additional individual difference measures (low intelligence and psychological instability) understood to be important predictors for future criminal behavior. The analytical strategy mirrors that of the full sample described previously. We begin with the measure of intellectual ability and examine both any criminal conviction and violent criminal conviction (see Figures 4a and 4b, respectively). Unlike the magnitude differences displayed previously using official statistics to capture early onset and chronic offending, the differences depicted in these graphs appear negligible. Next, we examine differences in long-term offending trajectories taking into account psychological instability. We present the findings for any criminal conviction and violent criminal conviction in Figures 4c and 4d, respectively. Similar to the previous analyses, the general pattern remains substantively the same.⁹

In sum, the findings from our prospective analyses are consistent and suggest that the ability to prospectively predict a group of high-rate, chronic offenders defined by a flat rate of offending over the life course based on key adolescent risk factors is problematic. Regardless of crime type or risk predictor employed, the substantive results presented here do not change demonstrating the robustness of the findings. The pattern among all groups of high-risk offenders reveals a high conviction rate in young adulthood followed by a significant declining pattern with age. Overall then, although magnitude differences are apparent, the criminal offending trajectories derived from the CCLS follow a general path that declines over time.

Retrospectively Defined Groups

In the next stage of our study, we employ a group-based trajectory analysis that defines offending trajectories retrospectively and examine whether risk factors identified in adolescence can prospectively differentiate these trajectory groups. We begin by predicting trajectory group membership. Conceptually, the group-based trajectory approach identifies groups of individuals who display similar behavioral trajectories over the life course (Nagin 2005). This analytic strategy is an advancement over the previous prospective analysis in that rather than examining average trajectories, group-based trajectory analysis allows for a within-group examination of life course offending trajectories, increasing our ability to isolate distinct pathways.

We use Nagin and Land's (1993) semiparametric group-based modeling approach (see also Nagin 2005) and estimate a zero inflated poisson form of a group-based trajectory model:

$$\ln(\lambda_{it}^j) = \beta_0^j + \beta_1^j(\text{age}_{it}) + \beta_2^j(\text{age}_{it}^2) + \beta_3^j(\text{age}_{it}^3),$$

where $\ln(\lambda_{it}^j)$ is the natural logarithm of the number of total convictions for persons i in group j at each age t . The equation is specified to follow a cubic function of age (age, age², and age³). This analysis results in the identification of a number of different groups of individuals who display similar behavioral trajectories from 18 to 55 years of age. We find that a four-group model provides the best representation of the conviction histories when considering parsimony and comprehensibility. Due to the large number of cases and long observation period under investigation in our data, the Bayesian Information Criterion (BIC) score continues to increase as more groups are added. The five- and

six-group models merely differentiate among those with zero or a negligible number of convictions and those repeatedly convicted during the observation period.

Moreover, the four-group model achieves the most important criteria for the adequacy of the trajectory models (Nagin 2005:88). Across the groups, the average posterior probability of group membership ranges from .85 to .95—these values are well above the .7 threshold recommended when determining whether the groups are distinct and the model fits well. Nagin (2005:88–90) also recommended three other criteria for judging model adequacy, including the calculation of the odds of correct classification for the distinguished groups, that the proportion assigned to each group closely corresponds to the probability of group membership for that group, and that the confidence intervals on group membership probabilities are reasonably tight. The four-group model presented here performs well by all these model accuracy criteria.

We present these four trajectories in Figure 5. Individuals are classified in the trajectory group for which their posterior probability is the highest. The first trajectory group (sporadic offenders) is made up of nearly 70 percent of the sample and evidences a near zero conviction rate throughout adulthood. The second trajectory group (low-rate offenders;

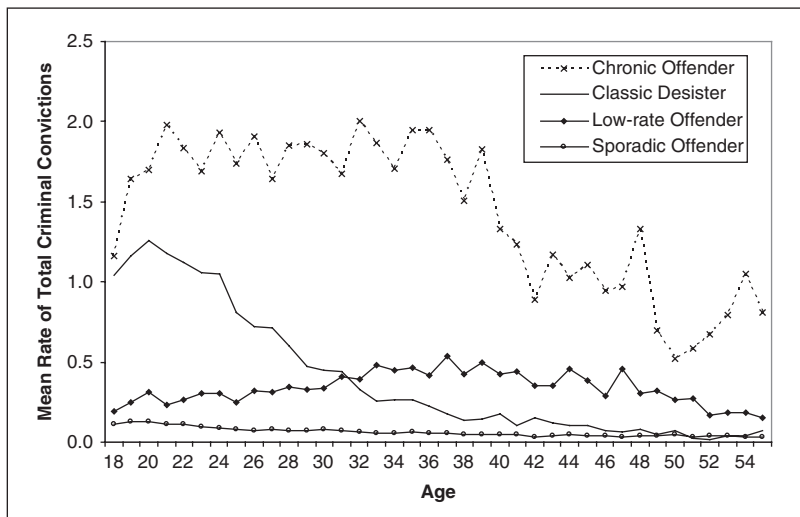


Figure 5. Latent offending trajectories for total criminal convictions (ages 18–55)

15 percent of the sample) follows a path that rises steadily through early adulthood and begins declining in the mid- to late 30s. The third group (classic desisters; 11 percent of the sample) follows the classic age-crime curve with conviction rates peaking in early adulthood and declining steadily thereafter. The final group, chronic offenders (4 percent of the sample), demonstrates a high rate of convictions throughout the 20s and 30s, followed by a declining pattern beginning in the late 30s.

With the trajectory groups identified, we examine whether these groups can be prospectively differentiated by adolescent risk factors. We display the means for our risk factors and individual characteristics (i.e., gender, ethnicity, marital status at age 18, and parental status at age 18) by group membership for total criminal convictions in Table 1. Significant mean

Table 1. Comparison of Adolescent Risk Factors by Trajectory Group Membership

	Sporadic Offender	Low-rate Offender	Classic Desister	Chronic Offender	
Full Sample (N = 4,615)	n = 3,288	n = 646	n = 487	n = 194	F statistic
Risk factors					
Early onset	.091 ^a	.143 ^a	.279	.321	72.129*
Chronic adolescent offender	.007 ^a	.014 ^a	.081 ^a	.176	116.046*
Personal characteristics					
Female	.140 ^a	.058	.024	.018	34.264*
Non-Dutch	.084 ^a	.141	.090 ^a	.193	13.965*
Married at age 18	.030	.025	.023	.014	.819
Child at age 18	.020	.035	.021	.022	2.064
Subsample (n = 618)	n = 407	n = 73	n = 105	n = 33	
Risk factors					
Early onset	.126 ^a	.216 ^a	.242 ^a	.483	11.400*
Chronic adolescent offender	.012 ^a	.026 ^a	.054 ^a	.174	10.925*
Low IQ	.100	.175	.200	.212	3.933*
Psychological instability	.043 ^a	.122	.176	.202	9.818*
Personal characteristics					
Non-Dutch	.034	.122	.078	.144	5.065*
Married at age 18	.001	.010	.030	.010	3.168*
Child at age 18	.000	.019	.017	.010	2.262

a. Significant mean difference at the $p < .05$ level; the comparison group is the chronic group.

*ANOVA f test is significant at the $p < .05$ level.

differences are estimated using an ANOVA test with a post hoc comparison to determine which groups significantly differed from one another. We report the significant differences using chronic offenders as our comparison group. The results illustrate some significant differences in the means across the four groups of offenders. For example, classic desisters and chronic offenders are more often characterized by early onset. In addition, as defined in the data, chronic offenders are characterized by chronic offending in adolescence. In contrast, we find few significant differences across the four groups when looking at individual characteristics. Overall, although there are some mean differences across the four trajectory groups, individuals identified as being at risk for high-rate, chronic offending in adulthood (i.e., those defined by early onset, chronic offending in adolescence, low intelligence, and/or psychological instability) are dispersed across all four trajectory groups. Moreover, there is no consistent patterning of risk factors distinguishing the chronic offender group.

Cross-Validation of Latent Classes of Criminal Behavior

In the final stage of the analysis, we use a cross-validation technique to examine our ability to predict offending patterns throughout adulthood. This strategy involves three steps. First, we randomly select half of the cases in our sample and estimate the parameters of a prediction model for trajectory group membership. To do so we use a multinomial logistic regression model in which the dependent variable is the trajectory group to which each person belongs (i.e., sporadic offenders, low-rate offenders, classic desisters, or chronic offenders). The independent variables include the four adolescent risk factors (i.e., early onset, chronic offending in adolescence, low intelligence, and psychological instability) and a number of individual characteristics (i.e., gender, ethnicity, marital status at age 18, and parental status at age 18).

In the second step, we use the estimated parameters of the prediction model obtained in the first step¹⁰ to predict the trajectory group membership for the cases in the second half of our data set. Specifically, for each person in the second half of our sample we take the values on the risk factors and individual characteristics and impute them into the prediction model with the parameters as estimated in the first step. Then, based on this prediction model, we calculate the probability that a person belongs to each of the four distinguished trajectory groups. Individuals are predicted to be a member of the trajectory group for which their calculated probability of group membership is the highest.

In the final step, we address our main research question and test the extent to which group membership in a trajectory group can be adequately predicted based on risk factors identified in adolescence and individual characteristics. That is, we examine whether a person's predicted group membership corresponds with or differs from a person's observed trajectory group. We present these results in Table 2.

We discuss only the results for the full sample (upper table) because the results for the subsample (bottom table) are very similar. Overall, the findings reveal that we accurately predict group membership for 71 percent of the cases (in bold in table). Although the general predictive accuracy of our model is informative, a more meaningful analysis for criminologists interested in criminal careers involves an assessment of the model's predictive accuracy within groups.

Due to their continued involvement in crime into later adulthood, we believe the two groups of greatest substantive interest are the low-rate and chronic offender groups. When we inspect the findings from our estimation analysis, we find that of the 328 cases observed to be members of the low-rate offender group, only 5 are predicted to be a member

Table 2. Comparison of Predicted Versus Observed Trajectory Group Membership

	Predicted Trajectory Group ^a			
	Sporadic Offender	Low-rate Offender	Classic Desister	Chronic Offender
Second half of the full sample (<i>n</i> = 2,275)				
Observed trajectory group				
Sporadic offender	1,598	2	5	0
Low-rate offender	322	5	1	0
Classic desister	238	6	14	0
Chronic offender	68	2	12	2
Second half of the subsample (<i>n</i> = 310)				
Observed trajectory group				
Sporadic offender	200	1	2	1
Low-rate offender	33	2	0	0
Classic desister	54	0	3	0
Chronic offender	13	0	0	1

Note: Bold figures represent the accurately predicted trajectory group membership.

a. Multinomial logistic model predicted trajectory group.

of that trajectory group. Consequently, we find that our prediction model accurately predicts slightly less than 2 percent of the low-rate offender cases. The results for the chronic offender group are very similar—only 2 percent ($n = 2$) of the cases predicted to be members of the chronic offender group are indeed members of that trajectory group. The remaining 98 percent of cases are predicted to belong to a less criminally active group. Overall then, when we disaggregate our data by trajectory group and examine the predictive ability of our model, our results illustrate poor predictive power. That is, excluding the sporadic offenders, our model accurately predicts less than 10 percent of the low-rate offender, classic desister, and chronic offender cases combined.¹¹

Concluding Remarks

This article contributes to the empirical literature on prediction by analyzing long-term patterns of offending (ages 18 to 55) for a large sample of convicted men and women in the Netherlands. Data collected by the Netherlands Institute for the Study of Crime and Law Enforcement offer a unique opportunity to conduct a partial replication and extension of the Sampson and Laub (2003) study. Two important findings stand out in our analysis. First, regardless of the type of crime or the specific risk predictor assessed, our findings indicate that although magnitude differences are readily apparent, criminal offending trajectories derived from the CCLS follow a general path that declines over time for all convicted offenders. These results lend support to Sampson and Laub's argument for a general process of desistance from crime. Second, despite the use of data covering a large portion of the life course, containing a large sample of serious offenders, and the application of an advanced statistical technique, our results are consistent with previous findings regarding the difficulty of predicting high-rate offenders prospectively (see e.g., Auerhahn 1999; Gottfredson and Gottfredson 1994; Laub and Sampson 2003; Sampson and Laub 2003).

We acknowledge two important limitations of the current study. First, due to data limitations we are only able to examine four adolescent risk factors. Moreover, the indicators of low intelligence and psychological instability are not optimal as they were gathered from judgments made by a military examination committee, which may be influenced by bias. It is important to note though that the patterns for low intelligence and psychological instability match those found for the early onset and chronic offending analyses. Second, our analysis

relies on official records of offending, which suffer from a number of important limitations but are recognized as a valid indicator of more serious crimes (Blumstein et al. 1986; Gove, Hughes, and Geerken 1985; Hindelang, Hirschi, and Weis 1979). To assess the robustness of our findings and identify inconsistencies that may have resulted from bias in the official data, we analyzed two conviction outcomes: any criminal conviction and violent criminal conviction. We believe the findings are noteworthy for their overall similarities across crime type.

The findings presented here have modest implications for extant criminological theory, future empirical research, and public policy. Our results lend support to the position that it is difficult to predict long-term patterns of criminal offending using risk factors identified in adolescence. Moreover, the fact that our data come from the Netherlands suggests that the results generated by Sampson and Laub (2003) are not unique to the United States or, for that matter, unique to Boston boys born in the late 1920s. As discussed earlier in this article, a number of criminological theories have focused on the developmental course of offending over time (e.g., Blumstein et al., 1986; Gottfredson and Hirschi 1990; Moffitt 1993). Moreover, these theories focus extensive attention on risk factors in childhood and adolescence. Our findings add a note of caution to theories that maintain that long-term offending patterns can be predicted using adolescent risk factors identified in advance. With respect to future empirical research, while it is the case that much current research focuses on identifying risk factors in childhood and adolescence, we believe our results suggest expanding the research focus to include an examination of factors and mechanisms in adolescence and adulthood that may redirect offending trajectories toward desistance from crime. This line of research is especially necessary among samples that have been identified as having a high risk of offending throughout their life course. We believe research that can identify the mechanisms that generate both behavioral stability and change within individuals will move the field forward.

Finally, our findings question public policies that rest on our ability to predict criminal behavior over the long haul. Although this idea has enormous appeal, the empirical reality suggests that prediction is at best problematic. Moreover, we are skeptical that better measures of risk factors or new statistical techniques will lead to substantial improvement in our capability to predict long-term behavior in advance. As demonstrated

throughout the history of criminology, our capacity to predict and distinguish a small group of high-rate offenders remains elusive.

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Notes

1. We note that our study is not a conventional illustration of a comparative cross-national study (see Farrington and Wikström 1994). However, we undertake a replication of a prediction study by Sampson and Laub (2003) using data from the Netherlands and compare the findings within an international framework. Although somewhat limited, this form of a quasi-cross-national comparative work is not new in criminology (see Farrington 1999).
2. For more information on the full Criminal Career and Life-Course Study (CCLS) sample, we refer readers to the CCLS codebook (Nieuwbeerta and Blokland 2003) and earlier publications based on this data set (Blokland, Nagin, and Nieuwbeerta 2005; Blokland and Nieuwbeerta 2005).
3. The selection of the 689 men was carried out as follows. First, because the archive of the Ministry of Defense does not hold detailed records for persons born prior to 1940, the sample was restricted to men born after 1940 ($N = 3,515$). Second, due to resource limitations, data collection efforts were restricted to gathering information for one-fifth of the cases in the total sample ($N = 736$). These men were randomly selected from the full sample. Finally, information for 47 of the men in the randomly selected subset could not be traced. In sum, files containing full medical and military records are available for the remaining group of 689 men. The final group is representative of men convicted in 1977 between the ages of 12 and 37.
4. While the General Documentation Files contain information on all offenses that lead to any type of judicial interference, here we use only information on those offenses that were either followed by a conviction or a prosecutorial disposition due to policy reasons, thereby excluding cases that resulted in an acquittal or a prosecutorial disposition due to insufficient evidence. The results of analyses conducted with these cases in the data are substantively similar.
5. Given its prevalence in 1977, the sample for driving under the influence was confined to 2 percent. Less common, serious offenses were oversampled, including:

25 percent of all robbery, public violence, and battery cases; 100 percent of all cases involving murder (including attempts), offenses against decency, rape, child molesting, and other sexual assaults; and 17 percent of all drug offenses. In addition, because the sample was one of cases not people, offenders who had two or more adjudications in 1977 were more likely to be included in the study. To deal with this sampling strategy we include a weight in all analyses so that the weighted sample is representative of the distribution of offense types and individuals tried in 1977.

6. The CCLS data is a conviction cohort consisting of persons who were tried in 1977. Therefore, unlike birth cohort studies, the age range in the sample is broad and skewed, ranging from 12 to 79 with a peak at age 18. This has two implications. First, the convictions recorded for the sample cover a long period—from 1924 to 2002 (when data collection concluded). Second, individuals were not randomly sampled from the entire population; they were all criminally active in 1977. To examine the extent to which historical changes and sampling properties affected our results, we divided the sample into three cohorts based on the individuals' age in 1977. The first cohort was comprised of offenders aged between 12 and 21 in 1977, the second of those aged 22 to 31, and the third of those aged 32 and up. Because the substantive findings reported in the following remain the same, we do not report the results by cohort here.
7. Negative binomial regression models using a measure of the frequency of convictions were also analyzed. The results mirror those obtained using the logistic regression models. We also graphed the raw data trajectories and found that the substantive findings did not change. These results are available upon request. Due to space considerations, we present only the smoothed trajectories based on the logistic regression models.
8. The slight up-tick in the mean predicted probability of conviction at older ages does not represent a trend in the observed data but is an artifact of the model.
9. Similar to our full sample analysis, we repeat the analysis with two alternative risk factor conceptualizations capturing those with an early onset of offending *and* a low intelligence or psychologically unstable designation. Of the sub-sample, 7 percent meet this criterion. We find that these results remain substantively the same.
10. These estimated parameters of the prediction model are available upon request.
11. The trajectory group and cross-validation analyses were also conducted using violent criminal convictions as the dependent variable. We found a three-group model best fits for trajectories of violent convictions. The results of the prediction analysis are substantively similar to those reported using total criminal convictions as the dependent variable. Specifically, excluding the sporadic

offender group, our model accurately predicts less than 7 percent of the cases (results available upon request).

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